

# Mayo Clinic Scottsdale Experience With Laparoscopic Nephroureterectomy

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## ABSTRACT

**Objectives:** To evaluate the efficacy of laparoscopic nephroureterectomy for patients with transitional cell carcinoma of the upper urinary tract.

**Methods:** Eighteen patients underwent attempted transperitoneal laparoscopic nephroureterectomy between June 2000 and October 2002. Mean patient age was 67.5 years. The specimen was removed intact through a 7- to 9-cm extraction incision in the lower midline. In the majority of patients, the distal ureter was dissected through the extraction incision.

**Results:** Sixteen cases were completed laparoscopically. Two cases required conversion to an open procedure. In these cases, dense fibrosis was present around the renal hilum preventing further dissection. The mean operative time was 180 minutes, and the mean estimated blood loss was 160 mL. The mean length of stay was 3.3 days. Complications included the 2 conversions, and 1 patient with a postoperative Mallory Weiss tear. No port-site or distant metastasis occurred; however, 1 patient developed a retroperitoneal recurrence.

**Conclusion:** Laparoscopic nephroureterectomy is an alternative to open nephroureterectomy. Cases with high-stage and grade may cause the laparoscopic dissection to be difficult. The extraction incision allows for easy dissection of the distal ureter.

**Key Words:** Transitional cell carcinoma, Laparoscopy.

## INTRODUCTION

Traditionally, the standard treatment for transitional (TCC) of the upper urinary tract is open nephroureterectomy (ONU) with excision of a cuff of bladder around the ureteral orifice. This requires either 2 incisions or an extended flank or midline incision. This can be associated with significant postoperative pain and morbidity.

Laparoscopic surgery in urology has been gaining widespread popularity over the last decade. The same principles of open nephroureterectomy can now be duplicated laparoscopically, thereby offering the patient decreased postoperative pain, a shortened convalescence period, and improved cosmesis.

## METHODS

Between June 2000 and October 2002, 18 patients with known or suspected TCC of the upper urinary tract underwent attempted laparoscopic nephroureterectomy (LNU). The mean patient age was 67.5 years (range, 46 to 84), and 15 of the patients were male. The disease was localized to the left in 10 cases and the right in 8 cases. Preoperatively, no patient chosen for the procedure was thought to have greater than stage T2 disease, and no patient had signs or symptoms of metastasis. Distribution of the tumors within the upper tract were as follows: 9 within the renal pelvis or calyces, or both, 4 within the renal pelvis/ureteropelvic junction, 2 in the proximal ureter, and 3 were multifocal with tumors both in the renal pelvis and mid or distal ureter.

All laparoscopic cases were performed transperitoneally utilizing 4 ports. Colon mobilization and exposure of Gerota's fascia was performed with the Harmonic scalpel. The ureter was clipped as far distally as possible early in each case. The renal vasculature was isolated, and the renal artery and vein were individually ligated with an Endo-GIA stapling device. Gerota's fascia was dissected from the lateral, posterior, and superior attachments using the Harmonic scalpel. A 7- to 9-cm extraction incision was made in the lower midline, and the kidney was removed within Gerota's fascia with an entrapment bag. The specimen was then sent for frozen section to confirm the diagnosis of TCC. The distal ureter was

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**Table 1.**  
Demographics and Histological Findings

No.	Age (years)	Sex	Pathology (stage, grade)	F/U (months)	Recurrence
1	72	Male	Ta, grade II	12	No
2	84	Male	Ta, grade II	20	No
3	68	Male	Ta, grade II	20	Distal ureter, bladder
4	72	Male	T3, grade III	12	No
5	83	Male	T3, grade III	5	Bladder
6	57	Female	Ta, grade II	11	No
7	46	Male	T3, grade III	11	Retroperitoneum
8	78	Male	T1, grade III	1	No
9	55	Male	T1, grade III	7	No
10	52	Male	T1, grade III	1	No
11	67	Male	T1, grade III	8	No
12	79	Female	T3, grade III	6	Hepatic, bone
13	64	Male	Ta, grade II	4	No
14	67	Female	T1, grade III	4	Bladder
15	67	Male	Ta, grade II	7	Bladder
16	72	Male	Ta, CIS, grade III	7	No
17	65	Male	T1, grade III	1	No
18	63	Male	T3, grade III	1	No

then dissected and excised by using a variety of techniques. In the initial case, the distal ureter was dissected down to the bladder and removed purely with the laparoscope in a patient with a TCC of the renal pelvis. The intramural portion of the ureter was thought to be completely resected. A combined cystoscopic and laparoscopic approach was incorporated in 2 patients to completely remove the ureter and bladder cuff by incising the ureteral orifice with a Collin's knife transurethrally in 2 patients. In the vast majority of cases, however, the distal ureter and bladder cuff were removed extravesically through the extraction incision. Routine postoperative follow-up consisted of cystoscopy with urine cytology every 3 months for the first 2 years. Computed tomography (CT) of the abdomen and pelvis and chest x-rays were obtained at 6 months and then yearly. An intravenous pyelogram was performed yearly.

## RESULTS

Laparoscopic nephroureterectomy was completed in 16 of 18 patients. Two patients required conversion to an open procedure. The mean operative time was 180 minutes (range, 120 to 240 minutes). The average estimated blood loss (EBL) was 160 mL (range, 50 to 1000 mL), and 2 patients required blood transfusion related to the surgical procedure. The mean length of stay (LOS) was 3.3 days (range, 2 to 7 days). Intraoperative complications included 2 cases that required conversion to an open procedure. Both cases involved a higher stage tumor (T3) than was suspected by preoperative CT or biopsy, or both. An extremely dense, fibrotic inflammatory reaction surrounded the kidney, ureter, and renal hilum. In 1 patient, the ureter was affixed to the inferior vena cava, and a plane was unable to be developed. In the other patient, an inadvertent venotomy was made in the renal vein requiring conversion. Postoperatively, a patient with a history of alcohol abuse developed a Mallory Weiss tear

of his esophagus requiring emergent endoscopy and blood transfusions. Two patients developed a postoperative ileus that resolved spontaneously in less than 5 days. One elderly patient had changes in his mental status, with no clear cause, which returned to baseline prior to discharge. One patient had postoperative anemia with a decrease in hemoglobin to 8.7 g/dL who was asymptomatic and did not require a blood transfusion. The final pathology revealed TCC in all specimens ranging in stage from Ta to T3 disease. The distal ureteral margin was negative in each case. Tumor grade and stage are listed in **Table 1**.

Our average follow-up to date is approximately 8 months. One case of distant metastasis has occurred. This occurred in a patient with high-grade disease who presented 4 months postoperatively with signs and symptoms suggestive of recurrence and was subsequently found to have liver and bone metastasis. A retroperitoneal recurrence occurred in one of the patients who required conversion. As mentioned previously, this patient had high-grade, stage T3 disease, and was found on 6-month follow-up CT to have a local recurrence. The 1 patient in whom the intramural ureter was dissected laparoscopically developed a bladder tumor at the remnant ureteral orifice at 6 months. He underwent subsequent excision of the residual intramural ureter and blad-

der tumor removal. Bladder recurrence of TCC following LNU was observed in 4 patients including the above-mentioned patient. No cases of port-site seeding have occurred to date.

## DISCUSSION

Transitional cell carcinoma of the upper urinary tract is traditionally managed by open nephroureterectomy through 2 separate incisions. Typically, both a flank incision and a Gibson or lower abdominal are needed to gain access to the kidney and distal ureter. Although endoscopic management of upper tract TCC is well established, it is still probably best reserved for small, low-grade tumors, or for patients with a poorly functioning contralateral kidney.

Laparoscopic nephroureterectomy was first performed by Clayman et al<sup>1</sup> in 1991, and many series have since followed with excellent results.<sup>2-5</sup> Postoperative pain, length of hospital stay, and convalescence period have all decreased when nephroureterectomy was performed laparoscopically.<sup>2-5</sup>

Detractors to the routine performance of LNU still exist. One of the concerns is the increased operative time. Although a learning curve in achieving laparoscopic skills is certainly necessary, once these skills are

**Table 2.**  
Comparison of the Largest Series of Laparoscopic Nephroureterectomy

Researcher	n	Approach	EBL (mL)	OR Time (hr)	Conversions	LOS (days)	F/U (mos)	Recurrences
Simon, et al	18	Transperitoneal	182	3.1	2	3.6	7.7	Total = 5 Bladder-4 Local-1 Distant-1
Gill, et al <sup>3</sup>	42	Retroperitoneal	242	3.7	2	2.3	11.1	Total = 11 Bladder-8 Local-0 Distant-3
Keeley, et al <sup>4</sup>	21	Transperitoneal	N/A	2.6	3	5.5	N/A	Total = 2 Bladder-N/A Local-1 Distant-1
Shalhav, et al <sup>2</sup>	25	Transperitoneal	199	7.7	N/A	3.6	39	Total = 13 Bladder-7 Local-3 Distant-3

obtained, the operative times decrease dramatically. In the more recent, larger series performed, the operative times are comparable to those of open surgery (**Table 2**). Hand-assist devices can help bridge the gap as well for surgeons who are in the early phases of learning laparoscopy.<sup>6</sup> Although multiple techniques exist for dissection of the distal ureter, we found the most efficient method was to perform the distal ureterectomy through the lower midline abdominal extraction incision. This dissection is both easy and familiar to urologists, as well as proficient. While many of the other methods are effective, such as dissection of the distal ureter, patient repositioning is required, and this can add up to 1 hour of operative time.<sup>7</sup>

Another concern about the laparoscopic approach is the oncologic efficacy of the procedure. Although long-term data are still required, LNU appears to be quite safe. McNeill et al<sup>5</sup> reported equivalent tumor control and long-term outcome in a retrospective report of 25 patients who underwent LNU and 42 patients who underwent ONU. Similarly, Washington University<sup>2</sup> observed comparable cancer-specific survival between open and laparoscopic groups. Reported recurrence rates for TCC in the bladder after open NU have ranged from 30% to 75%,<sup>8</sup> and the laparoscopic data are consistent with those results.<sup>2-4,8</sup> The patient in our series in whom we attempted to excise the intramural ureter laparoscopically developed a bladder recurrence at the site of the ureteral orifice. This patient required a repeat operation to excise his residual intramural ureter. Clearly, this example once again reveals the “field” nature of TCC, with the subsequent need to excise the complete ipsilateral unit that is involved. Although the majority of series have not witnessed any cases of port-site recurrence, 2 cases have been reported of port-site seeding.<sup>9,10</sup> Both cases involved kidneys that were removed intact through extraction incisions without morcellation. However, in 1 patient the entrapment bag was torn and the specimen was removed directly.<sup>9</sup> In the other patient, it is unclear whether an entrapment bag was used or whether the specimen was directly removed.<sup>10</sup> Certainly, the use of an entrapment bag and the absence of morcellation should reduce the risk of port-site recurrence.

The risk of local retroperitoneal recurrence is a concern. In our series, 1 patient with a high-grade, T3 lesion did develop a retroperitoneal recurrence at 6 months. The Washington University experience reported 3 patients with high-grade disease, ranging from stage T2 to T4, that

also recurred locally.<sup>2</sup> However, retroperitoneal recurrence would seem to be more a reflection of the aggressive nature of high-grade TCC rather than surgical technique.

Complication rates have been shown in multiple series to be comparable with those of ONU.<sup>2-5,7</sup> In fact, pulmonary complications, such as atelectasis and pneumonia, are witnessed less frequently with laparoscopy.<sup>7</sup> Both of our major complications involved cases in which conversion was required to an open procedure due to a higher stage tumor (T3) than was suspected by preoperative CT and biopsy. In both cases, an extremely dense, fibrotic inflammatory reaction surrounded the kidney, ureter, and renal hilum obliterating the normal tissue planes. In 1 patient, the ureter was completely affixed to the inferior vena cava, and a plane was unable to be developed safely laparoscopically. In the other patient, the vena cava and renal hilum were encased with fibrotic tissue and an inadvertent renal vein injury required conversion. Therefore, in patients with high-stage disease, great caution should be exercised, and an early conversion should be contemplated if the normal tissue planes appear obliterated. For the urologist just beginning to perform laparoscopy, we suggest beginning with a low-grade, low-stage tumor in the pelvis or calyceal system, as these tend to be the most straightforward.

## CONCLUSION

Laparoscopic nephroureterectomy is a safe, efficient alternative to open nephroureterectomy. High-stage and high-grade tumors may cause a dense fibrotic reaction making laparoscopic dissection difficult. Although multiple techniques are available for management of the distal ureter, the extraction incision provides for easy dissection of distal ureter and eliminates the need to reposition the patient.

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